



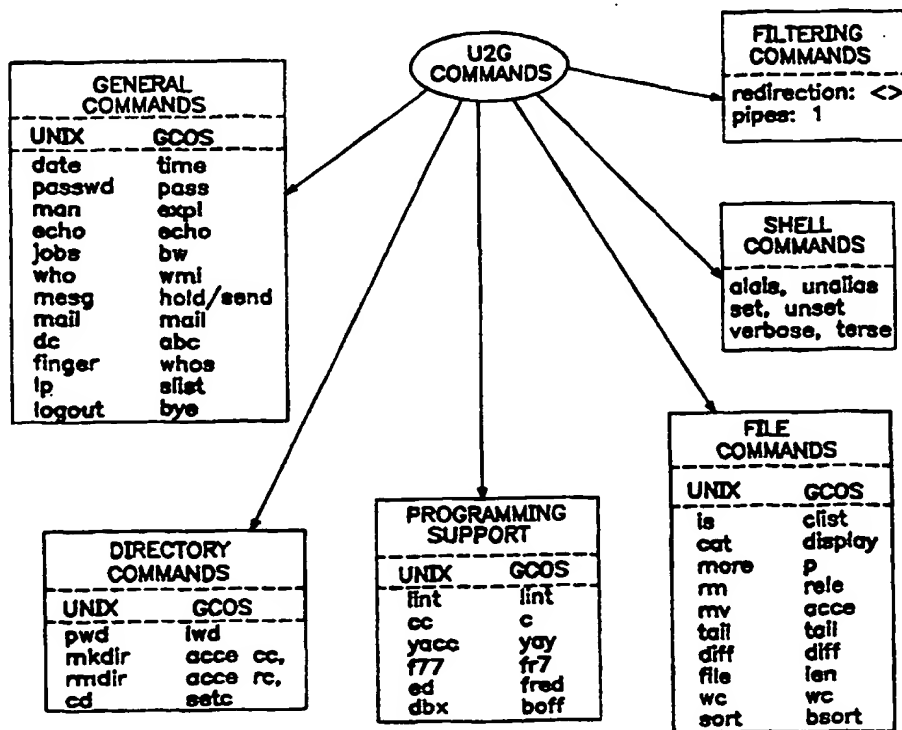
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(54) Title: AUTOMATICALLY INVOKED OPERATING SYSTEM TRANSLATOR

(57) Abstract

U2G is a software tool that runs on the (GCOS-8) operating system and enables it to recognize and process the commonly used commands of the (UNIX) operating system. (U2G) is a (UNIX-GCOS-8) translator that enables the GCOS-8 to recognize, accept and execute (UNIX) commands. Thus, it enables the (UNIX) users to work with the (GCOS-8) system without prior training. (U2G) can translate the most commonly used (UNIX) commands along with their respective options into equivalent (GCOS-8) Time Sharing System (TSS) commands. (U2G) can be used with a "Verbose" mode option which serves to provide descriptive information about the commands and the translation process. (U2G) contains a startup file that is executed at the beginning of every session in order to set up the environment.



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AUTOMATICALLY INVOKED

OPERATING SYSTEM TRANSLATOR

Field of the Invention

This invention relates to the field of computers and, more particularly to computer operating systems. Still more specifically, the presently preferred embodiment of this invention relates to the two operating systems, UNIX® (registered trademark of X/Open Company Limited, hereinafter "UNIX") and GCOS® 8 (registered trademark of Bull Worldwide Information Systems, hereinafter GCOS-8), and to the translation of commands and functions between these two operating systems.

Reference to Microfiche Appendix

For a complete source code listing of a computer program which incorporates the present invention, one may refer to the Microfiche Appendix filed concurrently herewith and incorporated by reference herein.

Background of the Invention

GCOS-8 is a proprietary operating system that provides the required basic functionalities for a family of large, powerful mainframes designed and manufactured by and for BULL. Although this operating system has many widely recognized advantages for developing data processing applications, it

has, because of its application history, a rather restricted set of commands for other types of applications such as word processing, scientific computing and non-numeric programming.

On the other hand, the UNIX operating system is more flexible and offers a user a higher degree of ease of operation. It has a larger set of commands by which a user can specify the desired objectives more quickly and in a more straightforward manner. In addition, many higher education facilities have been offering access to UNIX-based systems for the past decade such that a much larger proportion of recently graduated software/computer engineers are already familiar with UNIX. Thus, an operating system translator tool that enables a user who is capable in the use of UNIX to also readily skillfully use the less widely known, but important, GCOS-8 system is highly desirable.

The main problem in designing such a tool is that there are fundamental differences between the design philosophies of these two operating systems; i.e., they were devised with different goals and assumptions in mind. Whereas GCOS-8 is directed toward hosting database systems and other data processing applications, the UNIX operating system was designed to be process oriented. The "look and feel" of these two systems have little in common, and many of the UNIX capabilities are not present in GCOS-8.

Thus, development of a general interface that can completely map these two systems to each other is a difficult task.

A software tool, U2G (trademark of Bull Worldwide Information Systems, hereinafter U2G), which incorporates the present invention, is an operating system translator that not only acts as a front-end to the GCOS-8 system, but also enhances the capabilities of the GCOS-8 environment by incorporating a number of additional capabilities that UNIX provides.

Previous attempts to design UNIX to GCOS-8 interfaces were mostly confined to translating a collection of the majority of basic commands that are common to both operating systems. With this approach, only a limited set of inter-operating system capabilities could be provided, and the more sophisticated concepts, such as piping, were not achieved. Again, these shortcomings of the prior art were, for the most part, a by-product of the fundamental differences in the design philosophies of the two systems.

Objects of the Invention

It is therefore a broad object of this invention to provide a front-end user interface for the GCOS-8 operating system so that users who are familiar with the UNIX system and its operation can also use GCOS-8 with no training and with minimal knowledge of GCOS-8.

Another object of this invention is to enhance the capabilities provided by the GCOS-8 system as a result of providing a larger set of commands and functionalities.

It is a more specific object of this invention to provide for selective automatic invocation of the U2G translator program.

Summary of the Invention

Briefly, these and other objects of the invention are achieved by the U2G operating system translator for translating all the commonly used UNIX commands (more commonly called UNIX utilities) into equivalent GCOS-8 commands. U2G runs on the GCOS-8 command interpreter (TSS). Many essential options of the UNIX commands are also recognized. If an unknown command is entered, U2G conservatively assumes that it is a valid GCOS-8 command (or an executable) and passes it on to the GCOS-8 command interpreter without a change. When the appropriate option is selected, U2G provides information about the translation and describes commands. This mode of operation is called the "verbose" mode and may be disabled by entering the "terse" mode. U2G also provides on-line help screens and explain pages and simulates a semi-UNIX-like environment by providing facilities for using shell variables and aliases. U2G supports I/O redirection and simple command procedures, and simulates the piping of the commands. A startup

file, "u2grc", is first interpreted at the start of any session to set up the appropriate environment.

Description of the Drawing

The subject matter of the invention is particularly pointed out and distinctly claimed in the concluding portion of the specification. The invention, however, both as to organization and method of operation, may best be understood by reference to the following description taken in conjunction with the subjoined claims and the accompanying drawing of which:

FIG. 1 is a representation of an exemplary open computer complex environment in which the invention finds application, which open computer complex environment includes proprietary GCOS-8 system components and UNIX system components;

FIG. 2 is an alternative representation of the exemplary environment illustrating in more detail the apparatus of a proprietary GCOS-8 system server component of the open computer complex which includes UNIX system components;

FIG. 3 is an illustration of the overall architecture of a U2G software tool which includes the subject invention;

FIG. 4 is a high level block diagram of the command translator incorporated into U2G;

FIG. 5 illustrates the UNIX to GCOS-8 command hierarchy;

FIG. 6 is a basic UNIX to GCOS-8 flow diagram;

FIG. 7 is the main UNIX to GCOS-8 flow diagram;

FIG. 8 is the U2G batch processing flow diagram;

FIG. 9 is the U2G parsing flow diagram;

FIG. 10 is the U2G command preprocessing flow diagram;

FIG. 11 is the U2G filtering flow diagram; and

FIG. 12 is a flow diagram of an example of piping and input/output re-direction in U2G.

Description of the Preferred Embodiment(s)

OVERVIEW

Referring first to both FIG. 1 and FIG. 2, a GCOS-8 terminal 1 communicates with a GCOS-8 system 3 via bus 2 and I/O port (P) 10. Bus 2 is merely a representation of the connection between the terminal 1 and GCOS-8 system 3 and may actually constitute a path in a local area network (LAN), wide area network (WAN) or some other path implementation. As shown in FIG. 2, the exemplary GCOS-8 system comprises an I/O unit 9 (which includes a plurality of I/O ports 10), one or more CPUs 6 each having a cache unit 8 associated therewith which interfaces to a system bus 7, a system control unit 11 and such other system units 12 as may be included in the

GCOS-8 system, all coupled to the system bus 7, and a main memory 4 which, in this configuration, interfaces to the system control unit 11.

Referring again to both FIGs. 1 and 2 and as best shown in FIG. 2, a UNIX terminal represented by workstation 20 is also coupled to a port 10 via path 21. In addition, the UNIX workstation 20 may also be coupled to other UNIX system components 22 via path 24 and also to other proprietary system components 23 (which may or may not be GCOS-8) via path 25. As those skilled in the art will appreciate, FIG. 2 represents a typical open system combined with access to one or more proprietary systems, an open complex arrangement which has the potential for enjoying the best of both environments; however, it is well known that this result is notoriously difficult to accomplish in practice.

Referring now to FIG. 3 which is a very high level architectural diagram of the U2G tool, it will be understood that U2G is a translation program that runs on the GCOS-8 command interpreter (i.e., the Time Sharing System - TSS - command interpreter) and filters all user commands. A high level block diagram of the command translator per se is shown in FIG. 4. It translates the known UNIX commands to GCOS-8 commands and prints out useful diagnostics and explanations in the process. It is assumed that the users of this translator are familiar with the common commands available with at least one

of the two operating systems. The more or less directly equivalent UNIX and GCOS-8 commands are categorized in FIG. 5. It will be seen that U2G can translate a rich set of essential and useful UNIX commands (more commonly called the UNIX utilities) to their equivalent GCOS-8 commands. The set of commands supported by U2G is sufficient to help UNIX users break into the GCOS-8 environment.

U2G includes a table of equivalences between UNIX and GCOS-8 commands. Many essential options (e.g., those that make a command more specific) are also recognized. Several safety features are included in U2G. Upon receiving an unknown command, U2G assumes that it is a valid GCOS-8 command or an executable and passes it on to the GCOS-8 command interpreter unchanged.

U2G simulates a semi-UNIX like environment on GCOS-8 by providing facilities to use shell variables and aliases. As shown in FIGs. 4 and 6, a startup file "u2grc", which is much like the ".cshrc" file for the c-shell on UNIX, is first interpreted before starting a session. Commonly used aliases and other startup options can be specified in this file. Batch files consisting of a combination of GCOS-8, UNIX and U2G commands can also be interpreted by U2G. Since UNIX and GCOS-8 both use line oriented command interpreters as their primary shells, U2G is also line oriented.

U2G COMMANDS: The following commands are recognized by U2G at the command line, in the startup file and in a batch file.

ALIAS

Aliases can be defined as follows:

```
alias unix gcos
```

```
alias long "ls -l -s"
```

If a name has to be aliased to more than one word, the words must be enclosed in double quotes. The command 'alias' with no arguments will list out the current list of aliased terms.

UNALIAS

Previously defined aliases can be removed by issuing the unalias command. Enter:

```
unalias long
```

to remove the alias for long. The command 'unalias' used without any argument is illegal.

SET

Shell variables can be defined as follows:

```
set var variable
```

```
set short "really long name"
```

and used as \$var and \$short in any U2G command line. The command 'set' without any arguments will list out the currently defined shell variables.

UNSET

Previously defined shell variables can be unset using this command. Ex:
unset var.

SETTING THE PROMPT

The prompt is a special shell variable which defaults to the '%' symbol.
Enter:

```
set prompt MY_PROMPT
```

where MY_PROMPT is any valid string, to set the prompt to MY_PROMPT in the rest of the session with U2G.

VERBOSE

The user can set U2G to operate in a verbose mode by issuing this command. In this mode, U2G generates elaborate messages after each command describing everything about that command that could be helpful to the user. Command equivalences are shown, and diagnostic messages are produced.

TERSE

In this mode, the elaborate command descriptions are not produced; it is therefore most often used by experienced users.

BATCH FILES

Any combination of GCOS-8, UNIX and U2G commands can be collected together in a file and executed by U2G using the command '@filename' where filename is the name of the batch file containing the commands. Batch file executions may be nested in the sense that one batch file can contain a line invoking another batch file.

STARTUP FILE

During every run of U2G, a file named "u2grc" in the user's current directory is interpreted as a startup file.

KNOWN UNIX COMMANDS

A sample of the UNIX commands that are currently known to U2G are listed below. (Options are given in parentheses.) Attention is again invited to FIG. 5.

File commands:

| | | | | |
|----------|-----|------|------|------|
| ls (-ls) | cat | more | tail | diff |
| rm | cp | mv | wc | file |
| sort | | | | |

Directory commands:

| | | | |
|-----|-------|-------|----|
| pwd | mkdir | rmdir | cd |
|-----|-------|-------|----|

Programming support:

lint cc yacc f77 ed
dbx

General commands:

date passwd man echo jobs
who mesg mail dc finger
lp logout

PROCESS FLOW

It will be understood that the foregoing, in conjunction with FIGs. 1 - 12, inclusive, and the Microfiche Appendix referenced above and incorporated herein by reference, constitutes a full and comprehensive exposition of the invention sufficient to teach those skilled in the art to adapt the invention to diverse operating system combinations. However, the following description of a specific example of the process flow of the invention will provide a useful alternative disclosure which obviates the need to refer to the Microfiche Appendix.

SPECIFIC EXAMPLE

A file named "u2grc" in the user's directory is interpreted as the startup file and is executed for every session of U2G. Upon execution of this file, the environment will be set exactly to the user's previously selected preferences.

Among the tasks carried out are setting the desired aliases and other environment parameters. The startup file may include a request for the reporting of all of the parameters. For example, the following report that gives a list of defined aliases and shell variables may be displayed:

```
alias
ser      cp
stt      lss
sw       mkdir file
set
term     sun
user     demo
home     /user/home
```

By using this facility, an appropriate environment may be created for novice users, thereby relieving them from guessing how to use numerous options available in GCOS-8 and UNIX.

The foregoing examples are not exhaustive, but show only a sample of what can be accomplished with the system along with the responses. While the examples and functional description set forth above independently teach the invention to those skilled in the art, a comprehensive implementation of the

presently preferred embodiment is separately revealed in the Microfiche Appendix filed concurrently herewith and incorporated by reference herein.

Thus, while the principles of the invention have now been made clear in an illustrative embodiment, there will be immediately obvious to those skilled in the art many modifications of structure, arrangements, proportions, the elements, materials, and components, used in the practice of the invention which are particularly adapted for specific environments and operating requirements without departing from those principles.

WHAT IS CLAIMED IS:

1. An open computer complex comprising:

- A) a first computer system operating under a first operating system, said first operating system having a first command repertoire;
- B) a second computer system operating under a second operating system, said second operating system having a second command repertoire, said second computer system further including an operator terminal;
- C) interface means connecting said first and second computer systems, said interface means including an operating system translator, said operating system translator comprising:
 - 1) a table of equivalent commands in said first command repertoire and said second command repertoire;
 - 2) means for receiving a command from said second command repertoire which is to be executed in said first computer system;
 - 3) means for determining from said table a command in said first command repertoire which is an equivalent command of said command from said second command repertoire which is to be executed in said first computer system;

4) means for executing said equivalent command in said first computer system; and

5) means for selectively displaying on said operator terminal messages describing the relationship between said command from said second command repertoire and said equivalent command; and

D) means for selectively automatically invoking said interface means upon startup of said second computer system.

2. The open computer complex of Claim 1 in which said first operating system is UNIX and said second operating system is GCOS-8.

3. The open computer complex of Claim 1 in which said first operating system is GCOS-8 and said second operating system is UNIX.

4. An open computer complex comprising:

- A) a first computer system operating under the GCOS-8 operating system having a first command repertoire;
- B) a second computer system operating under the UNIX operating system having a second command repertoire;
- C) at least one of said first computer system and said second computer system further including a user terminal;
- D) interface means connecting said first and second computer systems, said interface means including an operating system translator, said operating system translator comprising:
 - 1) a table of equivalent commands in said first command repertoire and said second command repertoire, said table of equivalents including the following equivalent file commands:

| <u>UNIX</u> | <u>GCOS-8</u> |
|-------------|---------------|
| ls | clist |
| cat | display |
| more | p |
| rm | rele |
| mv | acce |
| tail | tail |
| diff | diff |

| | |
|------|--------|
| file | len |
| wc | wc |
| sort | bsort; |

- 2) means for receiving a command from said second command repertoire which is to be executed in said first computer system;
- 3) means for determining from said table a command in said first command repertoire which is an equivalent command of said command from said second command repertoire which is to be executed in said first computer system;
- 4) means for executing said equivalent command in said first computer system; and
- 5) means for selectively displaying on said user terminal messages describing the relationship between said command from said second command repertoire and said equivalent command; and

E) means for selectively automatically invoking said interface means upon startup of at least one of said first and second computer systems.

5. The open computer complex of Claim 4 in which said table of equivalent commands in said first command repertoire and said second command repertoire includes the following equivalent programming support commands:

| <u>UNIX</u> | <u>GCOS-8</u> |
|-------------|---------------|
| lint | lint |
| cc | c |
| yacc | yay |
| f77 | fr7 |
| ed | fred |
| dbx | boff. |

6. The open computer complex of Claim 5 in which said table of equivalent commands in said first command repertoire and said second command repertoire includes the following equivalent directory commands:

| <u>UNIX</u> | <u>GCOS-8</u> |
|-------------|---------------|
| pwd | lwd |
| mkdir | acce cc, |
| rmdir | acce rc, |
| cd | setc. |

7. The open computer complex of Claim 6 in which said table of equivalent commands in said first command repertoire and said second command repertoire includes the following equivalent general commands:

| <u>UNIX</u> | <u>GCOS-8</u> |
|-------------|---------------|
| date | time |
| passwd | pass |
| man | expl |
| echo | echo |
| jobs | bw |
| who | wmi |
| mesg | hold/send |
| mail | mail |
| dc | abc |
| finger | whos |
| lp | slist |
| logout | bye. |

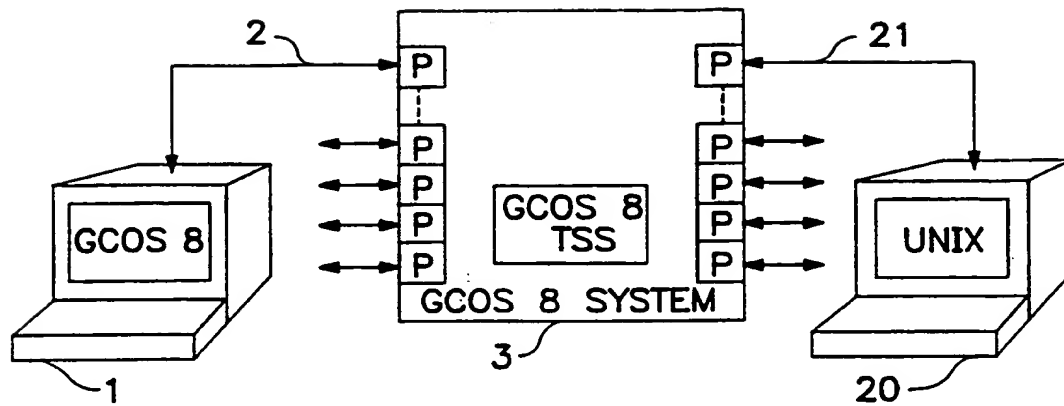


FIG. 1

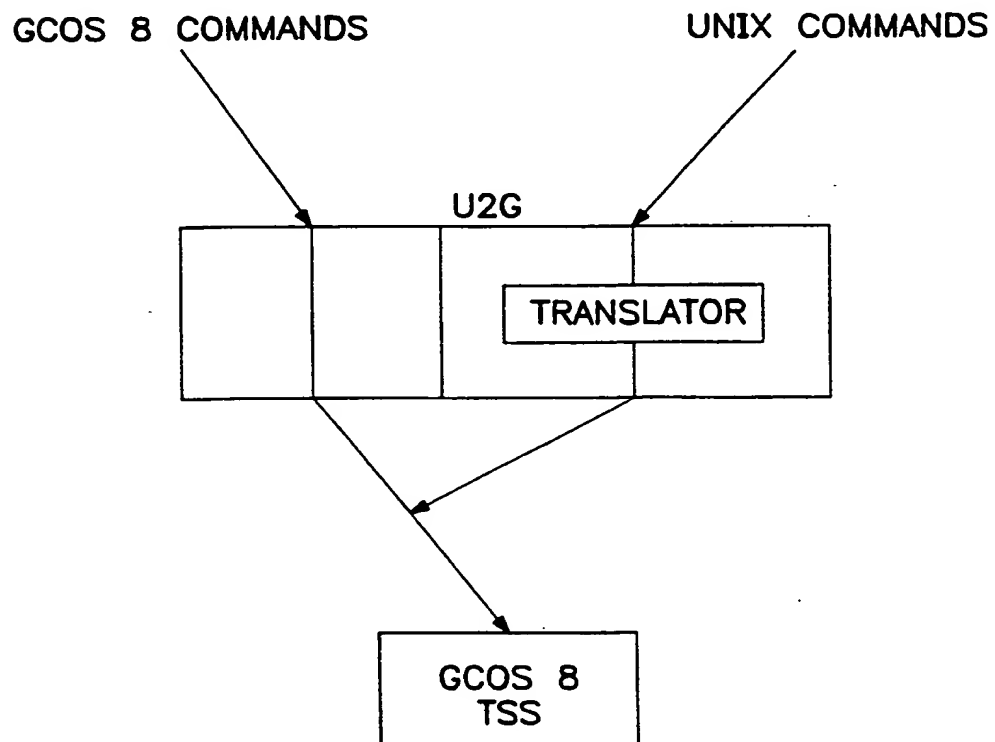


FIG. 3

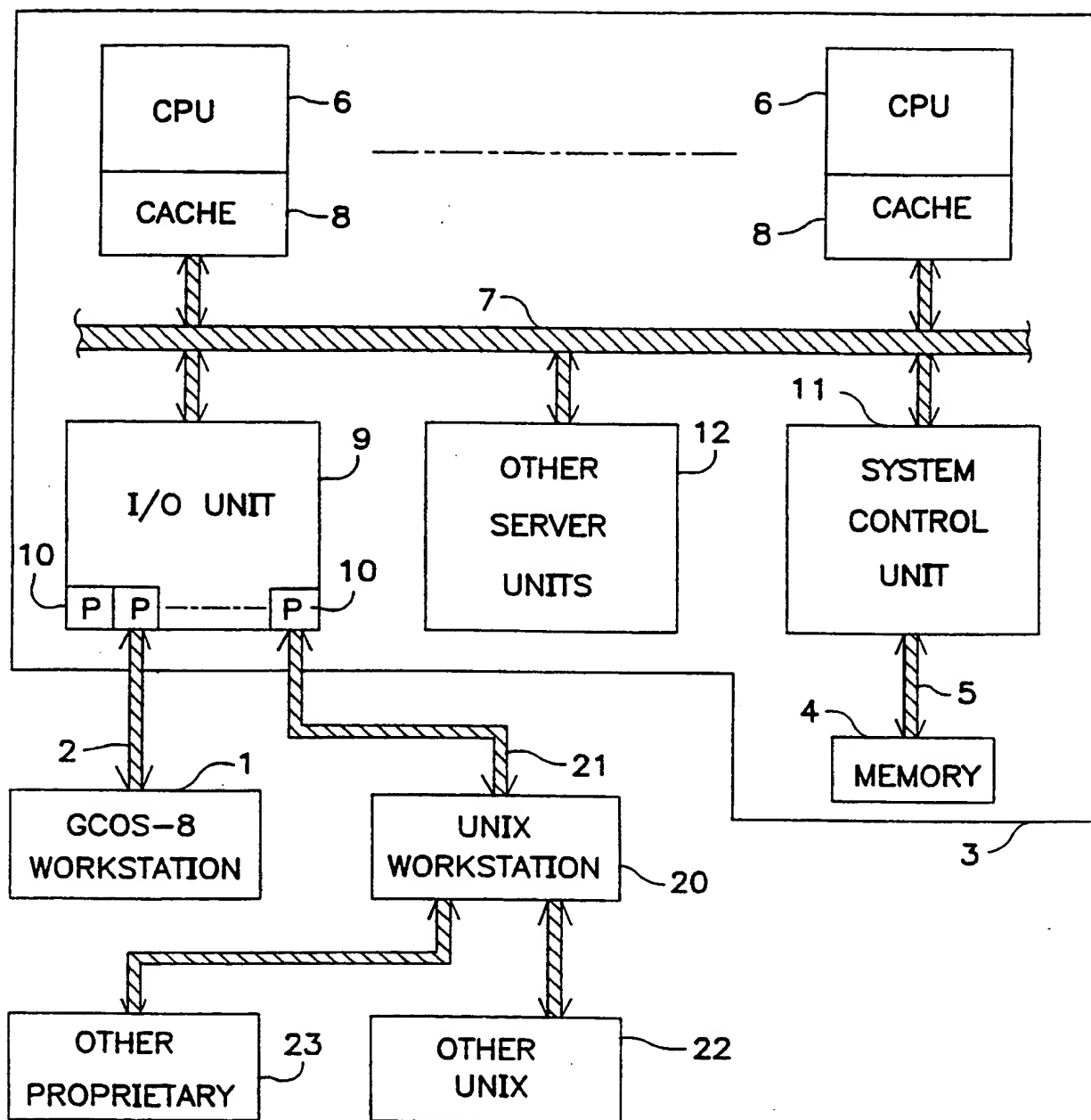


FIG. 2

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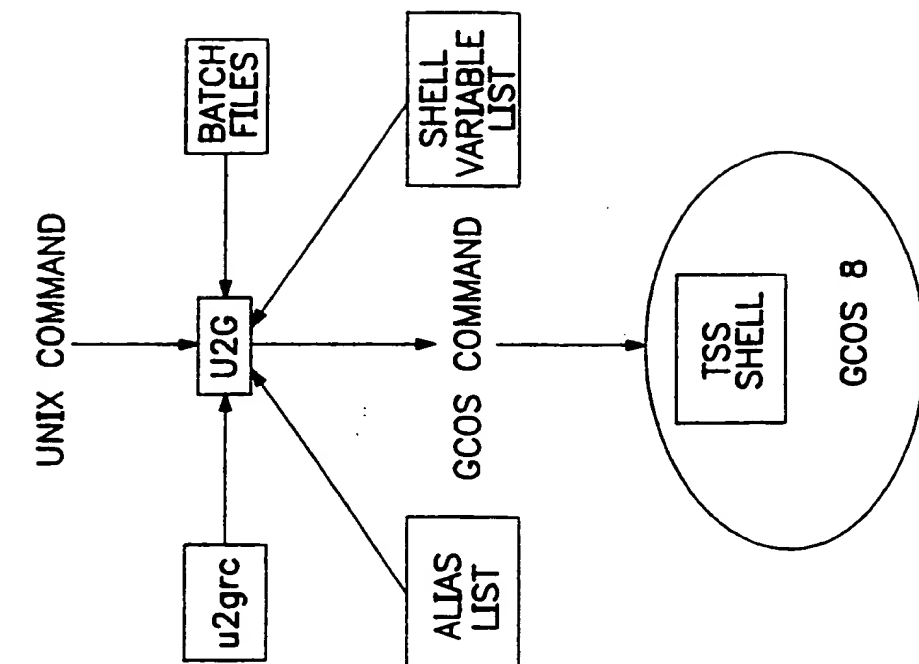


FIG. 4

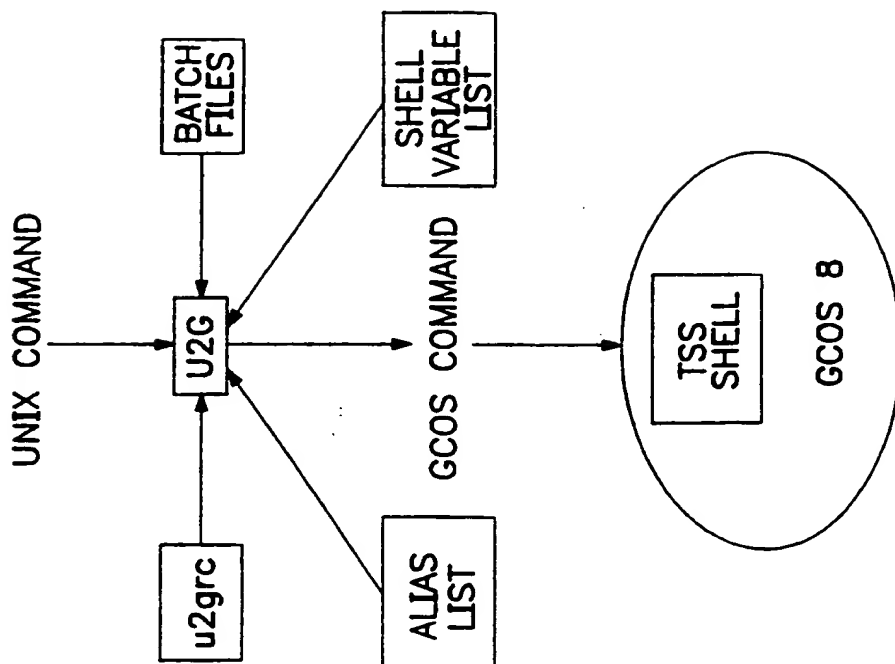
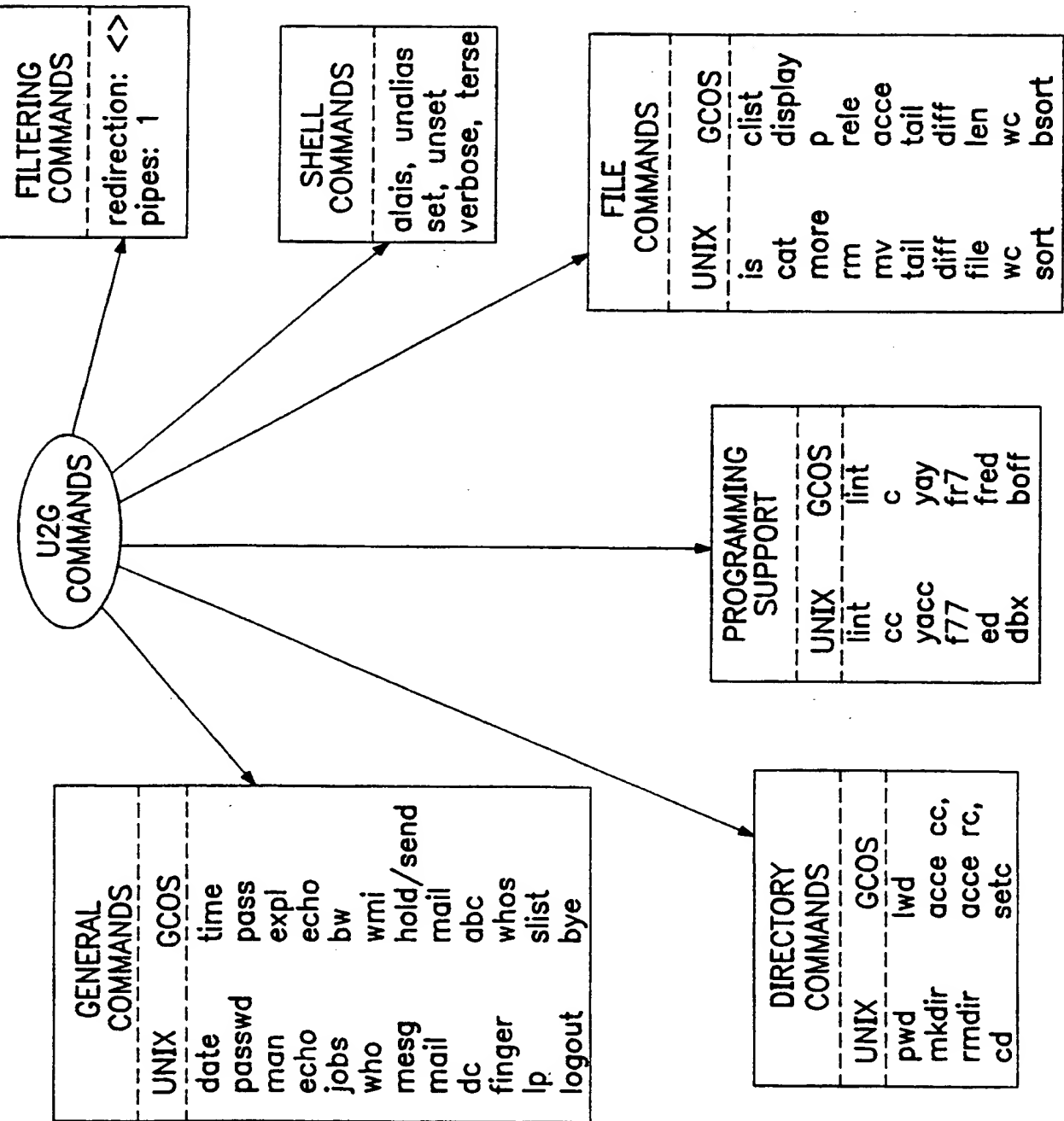


FIG. 6



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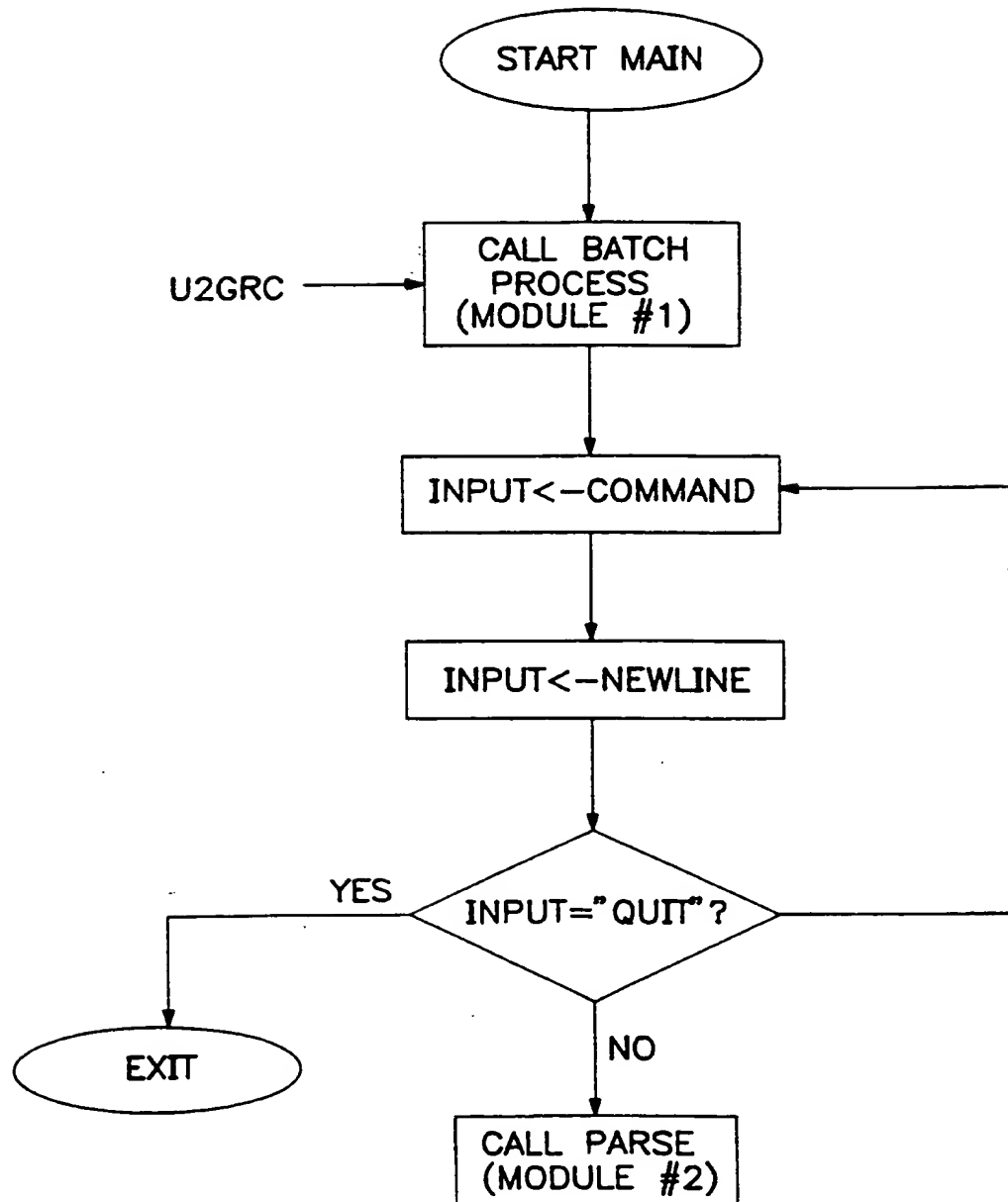


FIG. 7

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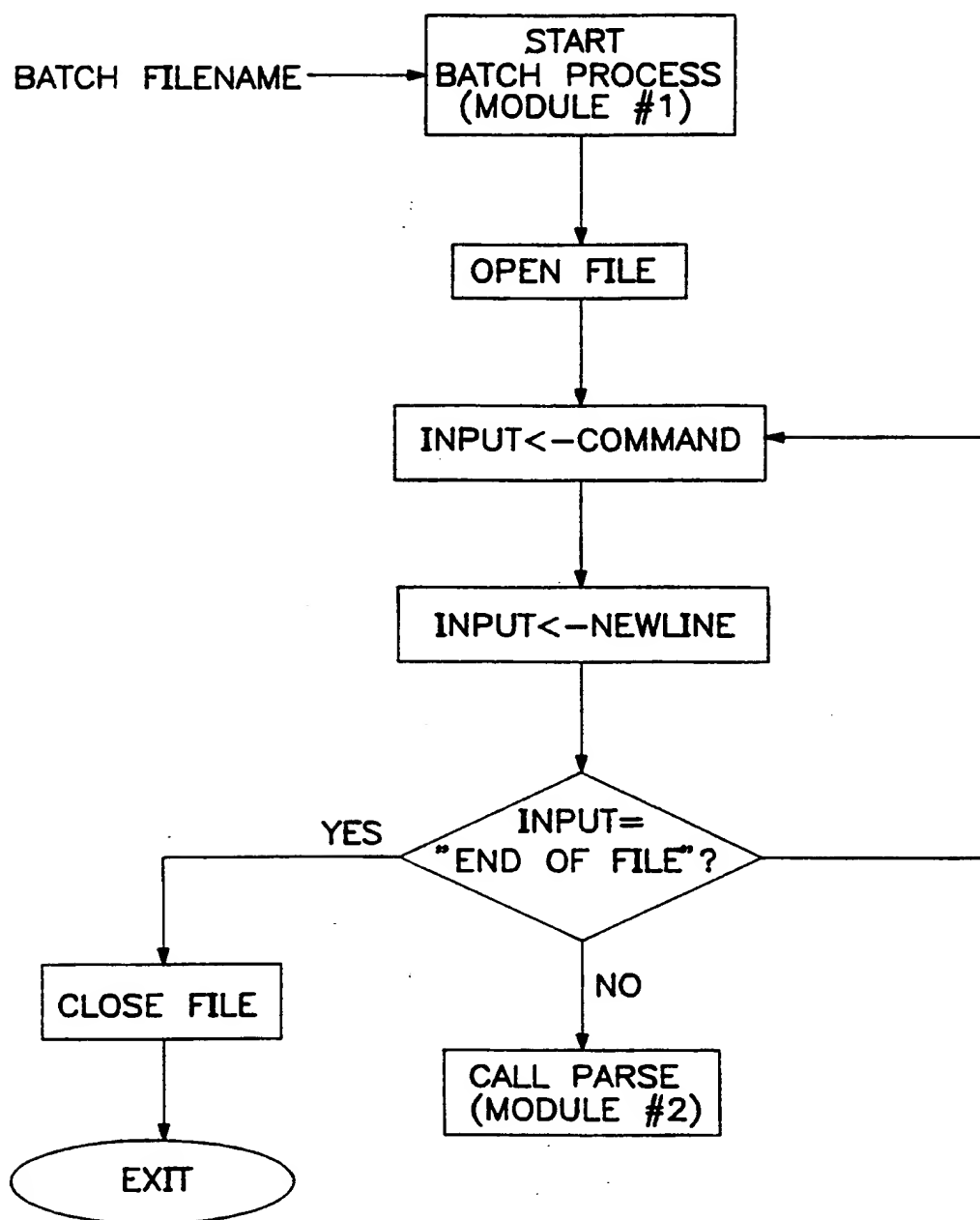


FIG. 8

7 / 10

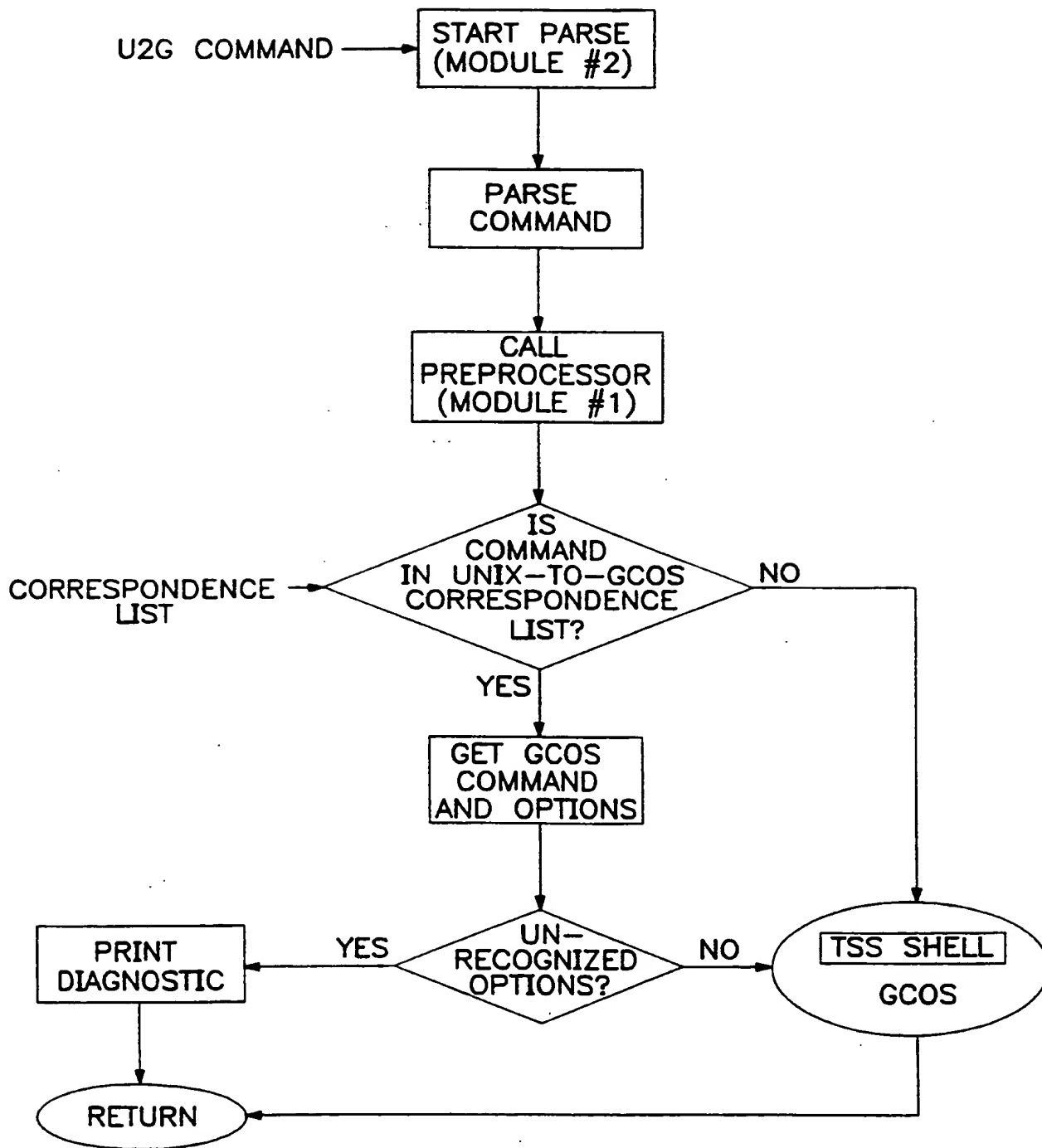


FIG. 9

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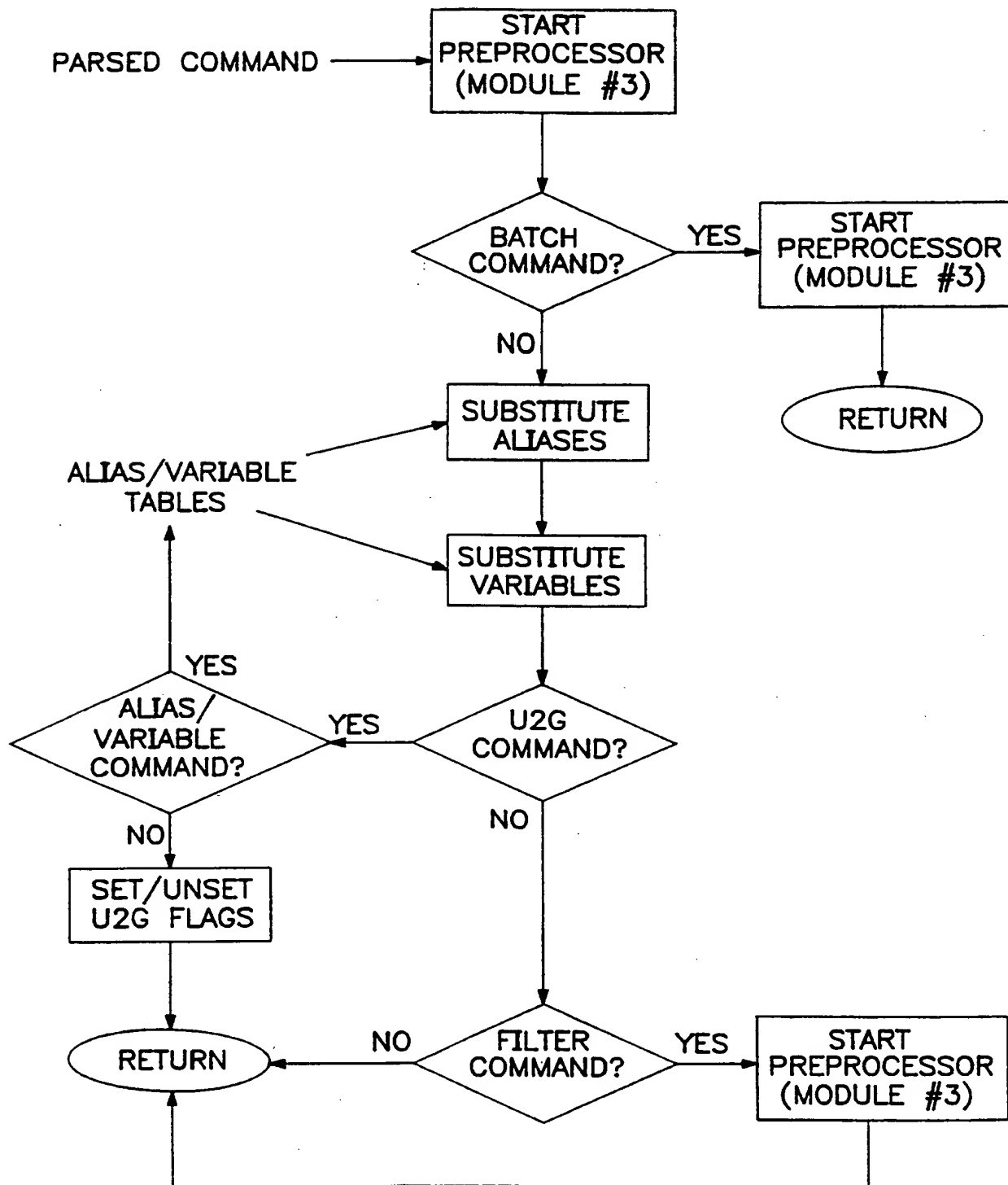


FIG. 10

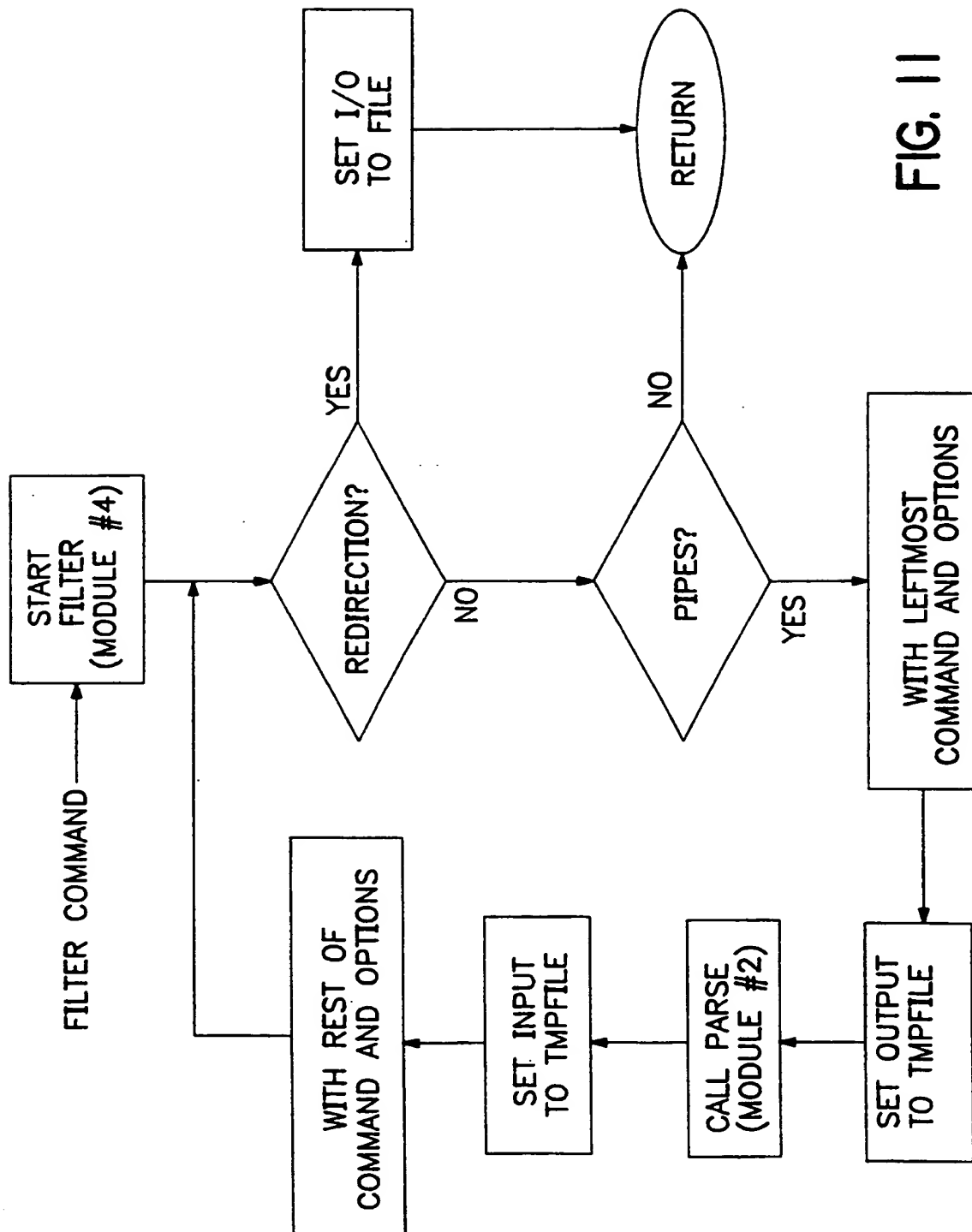


FIG. 11

10/10

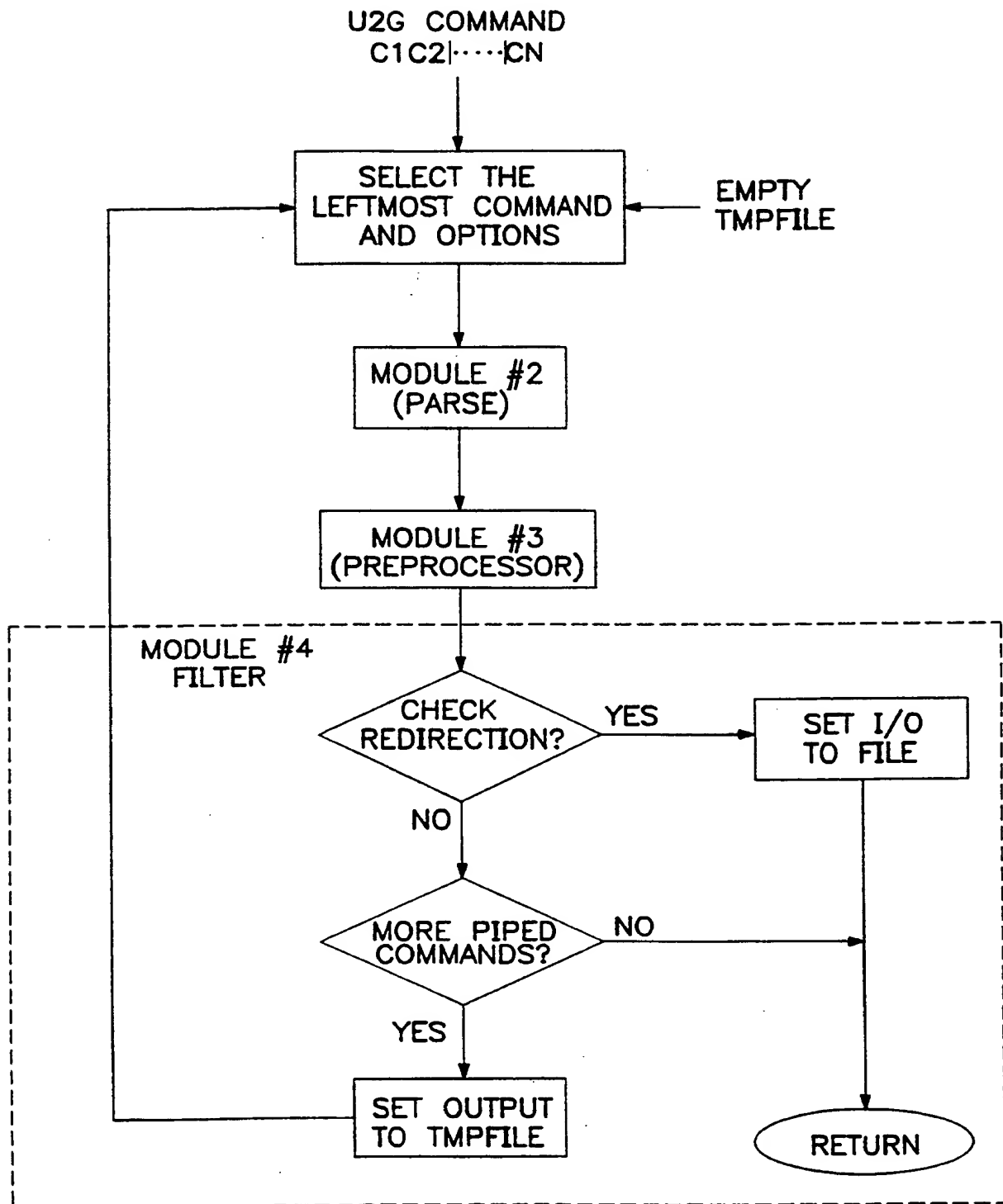


FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/07335**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) : G06F 9/00, 15/00

US CL : 395/500

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 395/500, 700

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Please See Extra Sheet.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| Y | US, A, 5,361,358 (COX ET AL) 01 November 1994, see the abstract, figs. 2-4, col. 1, lines 44-68. | 1 |
| A | | 2-7 |
| A | US, A, 4,744,048 (BLANSET ET AL) 10 May 1988, see the abstract. | 1-7 |
| A | US, A, 5,339,238 (BENSON) 16 August 1994, see the abstract. | 1-7 |
| A, E | US, A, 5,530,820 (ONODERA) 25 June 1996, see the abstract. | 1-7 |

☐

Further documents are listed in the continuation of Box C.

☐

See patent family annex.

| | |
|---|--|
| * Special categories of cited documents: | *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention |
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| *P* document published prior to the international filing date but later than the priority date claimed | |

Date of the actual completion of the international search

16 JULY 1996

Date of mailing of the international search report

30 JUL 1996

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Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/07335

B. FIELDS SEARCHED

Electronic data bases consulted (Name of data base and where practicable terms used):

APS

(translat? or conver?)(5a)(os or (operating system))

table#; interfac###; UNIX